

Frequently Asked Questions Regarding Acute Exposure Guideline Levels (AEGLs) in Emergency Planning and Response

Why was the U.S. EPA's AEGL program initiated?

After the Bhopal chemical plant accident in 1984, both industry and Federal organizations began many initiatives to better develop standardized emergency planning and response tools to include exposure levels to estimate health effects from different concentration of chemicals. However, these efforts were not coordinated or standardized. As a result, in 1996 the National Advisory Committee (NAC) on AEGLs was established under the Federal Advisory Committee Act with a charter to establish standardized emergency guidelines levels. The NAC-AEGL is co-chaired by the US Environmental Protection Agency (EPA) and a representative from the chemical industry. It includes members from various Federal organizations (such as the EPA, CDC, ATSDR, DOT, DOD), States, and industry and academia. The NAC-AEGL process includes a public review period (through the Federal Register) and finalization when approved and published by National Research Council (NRC).

What values have been used in the past? How do AEGLs relate to ERPGs?

As indicated for almost ten years various groups established emergency planning tools and models – to include some acute exposure levels. One of the most well known and used set of acute exposure levels to date has been the Emergency Response Planning Guidelines (ERPGs) established by the American Industrial Hygiene Association (AIHA). The ERPGs are essentially the predecessors of the AEGLs – and also provide three basic levels of health effects for single one time exposure to chemicals. However, the models used to develop ERPGs are considered less-advanced, and the process and documentation does not go through extensive review. Specific there is know opportunity for public comment and ultimately they values are not federally endorsed.

How are the AEGLs determined? Is there new science involved?

The most current risk assessment models are used to evaluate *existing* human and animal toxicity data to estimate three threshold toxicity levels for each chemical reviewed under the NAC-AEGL process. These levels (generically represented in Figure 1) each represent the estimated point above which an increasingly significant health effect will begin to occur amongst some exposed individuals. In addition, state of the art models are used to identify the relationship between the concentration of a chemical and the amount of time a person is exposed. The relationship of concentration and time was not previously understood well enough to be quantified in previous emergency planning values, yet it has been understood that this relationship is important to determining health outcomes. The use of these advanced model results in AEGLs for five one-time exposure periods including 10 minutes, 30 minutes, 1 hour, 4 hours, and 8 hours. For every chemical studied under the AEGL process, a detailed document is produced that summarizes the threshold toxicity levels, the exposure studies that have been conducted to date, chemical-specific information, and data on both short-term and long-term exposures.

Is there specific guidance on how to use AEGLs or what actions should occur at each Level?

Thus far, the only official applications involving AEGLs (or their predecessors - the ERPGs) include the use of ERPG/AEGL Level 2, specifically, by the DOT in its development of the isolation zones distances and protection zone distances for chemicals in the Emergency Response Guidebook and the guidance provided by the US EPA regarding the development of facility Risk Management Plans.

It is not within the scope or charter of the NAC-AEGL to recommend specific actions that should or could be taken at a given AEGL level. However, they are developed with a general understanding that in emergency planning and response, AEGLs will typically be used in combination with computer-assisted air dispersion models to estimate vulnerability zones or evacuation zones associated with accidental chemical releases. Dispersion models will take into account the quantity and rate of release of the chemical, the volatility of the substance, the wind speed and wind stability at the time of the release, and topographical characteristics in the area. The models will estimate the airborne concentrations of the "plume" or the chemical cloud as it is dispersed. Human health risks are described by comparing the estimated airborne concentrations of the chemical with the various AEGL values to determine appropriate response in various areas.

The three AEGL health effect levels allow emergency planners and responders to prioritize resources and activities associated with a chemical release. General guidance provide by the USACHPPM regarding decisions at various AEGL levels is presented in Figure 3. Further information regarding the applications of short-term exposure limits such as AEGLs may be obtained in Technical Guidance for Hazards Analysis (U.S. EPA, 1987).

More technical questions:

The AEGL generic definitions indicate 'incapacitating' or 'permanent' effect above AEGL 2. This sound like serious effects yet many applications use this as the criteria for evacuation. Wouldn't the AEGL 1 be more appropriate?

These do sound like alarming exposure levels. There are 3 reasons why these values are appropriate however: 1) the health effects would begin ABOVE the AEGL 2 and initially only in the most susceptible people (like those already ill); 2) the actual health effect caused by a specific chemical are not generally as severe as these generic definitions sound (see HPPM Facts sheet on Nerve and HD

Agent AEGLs; the levels represented by AEGL 1 are on the odor of common occurrences (such as exposures during pumping gas, cleaning, and are not generally a priority for evacuation which must be balanced with critical assets and logistical dangers.

The generic AEGL level description do not provide a clear understanding of the specific health effects are associated with a chemical I am evaluating – how can I get this information?

The NAC-AEGL completes its development of AEGLs for a given chemical by having the NRC publish the information in reports that are available for viewing via the Internet or hardcopy purchase. Each report is a volume containing technical discussion of the AEGLs and associated health effects demonstrated by available toxicity data. Approximately five chemicals are addressed in each volume. Despite the thoroughness of these documents they are written on a very technical level – as such some organizations have assisted users by summarizing and translating the information. For example – the USACHPPM has prepared Fact Sheets on the health effects for the warfare agents sulfur mustard and nerve agents (available upon request).

In the real world, exposure durations will vary – how do I account for durations not exactly at the 10 min, 30 min, and etc times that AEGLs are derived for?

Though AEGLs are presented as a set of specific concentrations for given times, the AEGL derivation includes a chemical-specific time extrapolation model where the concentration to the "n" power multiplied time ($C^n \times T$) can be used to determine the concentration for any duration 8 hours or less.

What about exposures greater than 8 hours?

The toxicity data representing a brief one-time exposure to a chemical cannot be extrapolated indefinitely, and should not be extrapolated to durations much beyond from the exposure duration used in the actual laboratory study. The NAC-AEGLs has chosen not attempt to determine the accuracy of their model beyond 8 hours. As a result, any user extending the model to exposure duration longer than 8 hours is doing so based on his/her own judgment. For example - if the underlying study used to establish the AEGL was a 4-hour or greater study, it may be deemed reasonable to extend the model to a period as long as 24 hours. Extending the AEGL model beyond 24-hour exposure durations in any circumstance is not advised.

References/Additional Information:

- Series of USACHPPM Fact Sheets - contact USACHPPM 410-436-1010
 - ➔ **Basic Questions Regarding AEGLs and Their Application, USACHPPM 2006**
 - ➔ **Detailed Facts Regarding Health Effects Associated with AEGLs for.... nerve agents, sulfur mustard, 2006**
- Chemical Stockpile Emergency Preparedness Program (CSEPP): *General Guidance Regarding AEGLs and CSEPP*, 2002
- National Research Council (2001). *Standing Operating Procedures for Developing Acute Exposure Guideline Levels for Hazardous Chemicals*. National Academy Press, Washington, D.C. <http://www.nap.edu/index.html>
- 2004 Emergency Response Guidebook – Guidebook For First Responders During Initial Phase Of A Dangerous Goods/Hazards Materials Incident; for copies contact www.jjkeller.com.

